

4: Feb. 57.

THE INFLUENCE OF ANÆSTHESIA ON THE SURGERY
OF THE NINETEENTH CENTURY.

ADDRESS OF THE PRESIDENT.

BY

J. COLLINS WARREN, M.D., LL.D.,
BOSTON.



*Reprinted from the
Transactions of the American Surgical Association.
1897.*



*One of the earliest operations under ether at the
Massachusetts General Hospital*

ADDRESS OF THE PRESIDENT.

THE INFLUENCE OF ANÆSTHESIA ON THE
SURGERY OF THE NINETEENTH
CENTURY.

BY J. COLLINS WARREN, M.D., LL.D.,
BOSTON.

GENTLEMEN: In selecting a topic for the annual address before such a body as this, it seemed to me desirable that the opportunity should not be lost to refer to the great event, the fiftieth anniversary of which has so recently been celebrated—an event which is so indelibly associated with American surgery, but one in which the whole world joined with us in commemorating.

As one of the staff of surgeons whose predecessors played so prominent a part in the introduction of anæsthesia, I feel it incumbent on me to recall to you today some of the great changes which it helped to bring about.

Let me turn your attention first to the century which preceded anæsthesia. It is difficult to realize the crude state of surgical knowledge and technique and the relation it still bore to medicine even so late as the eighteenth century. In the previous century it was quite beneath the dignity of a medical man of standing to do any surgical work.¹ Capital operations were, however, performed, for we read that Abraham Cyprianus, of Amsterdam, toward the end of the seventeenth century had performed lithotomy 1400 times, and had also done abdominal sec-

¹ Fr. Hoffman: "Der medicus soll nicht schneiden, brennen, noch Pflaster auflegen, weil es wieder die Würde eines medici nationalis ist, denn es sind fast überall Barbierer, Bäder, und Steinschneider zu haben." *Politischer Medicus*, S. 57.

tion and had championed radical operations for hernia. Amputations were still performed in a very crude way, and in spite of Paré's teachings of one hundred years before the management of hemorrhage appears to have been of a most primitive character. They were confined to fingers and toes, the forearm and the leg, amputations above the elbow or knee being regarded as a very dangerous procedure. The introduction of the tourniquet by Petit, in 1718, brought with it a greatly improved technique and made possible the selection of a point of election for amputations and the more general use of the ligature, and secured the permanent abandonment of the cautery and styptics.

The prejudice against surgery, however, still prevailed, and those who continued to advocate a union of surgery with medicine lost caste with their associates. The students in Freiburg threatened to mob von Wuthwehr, who, in 1774, pointed out the necessity for a union of surgery with medicine. Toward the middle of this century schools of surgery were established for the benefit of the armies, and more attention was paid to instruction in this department at the universities. It is recorded, however, that in Germany at this period it was still considered an important part of the duties of the military surgeons to shave both privates and officers. Finally the Academy of Surgery was founded in 1731. The degrading association of barbers and surgeons was abolished in 1743 at Paris by an edict, and the example was speedily followed, in 1745, by a similar Act in the English Parliament. Freed from this galling servitude, surgery became a separate and distinct branch, to be ever afterward studied and cultivated by educated members of the profession.¹ In England particularly, owing to the more careful attention to the study of anatomy, the technique of surgical operations greatly improved, and many of the methods of operating still in use today trace their origin to this period, such as operations for stone, the removal of tumors, and amputations.

Pott undertook to divest surgery of much of its horrors.

¹ Dunglison: History of Medicine.

A prophetic utterance of Pott in one of his books is interesting: "Many and great are the improvements which the chirurgic art has received within the last fifty years; and much thanks are due to those who have contributed them; but when we reflect how much remains to be done, it should excite our industry rather than our vanity. Our fathers thought themselves a great deal nearer to perfection than we have found them to be; and I am much mistaken if our successors do not in more instances than one wonder both at our inattention and ignorance."

The means of teaching surgery in Paris was limited, owing to the bad condition of the hospitals. In the Hôtel Dieu the operating theatre was in the St. Jerome Ward, where more operations were said to be performed than in any hospital in Europe. It was placed almost directly over the dead-house, the odors of which were quite perceptible. This ward accommodated twenty beds and an out-patient department. In some of the adjacent wards the walls were soiled with expectorations and the floors with the discharges of the patients. The mortality in this hospital before the Revolution was one death to every 4.5 patients who entered. This included many persons who were hardly ill, the insane, and pregnant women. It was the rule that every case of amputation of a limb died.

In 1787 a school of practical surgery was founded by Desault, and the union of the teaching bodies in medicine and surgery was effected in 1794, when the Écoles de Santé were established. (These names were soon changed to the Écoles de Médecine.)

In England at this period surgery was in a much better condition. This was owing to the fact that the teaching was done largely in private schools and by men of worldwide reputation, for these were the days of the Bells and Hunter. Much as the latter did for anatomy, pathology, and surgery, the prejudices of early education still clung to him. In 1753 Hunter was advised to study medicine, rather than surgery, as a higher branch of the healing art, and he continued to regard an operation as a tacit acknowledgment of the insufficiency of medicine.

The horrors of surgery without anæsthetics caused even surgeons themselves to look upon operative surgery as the lowest, poorest side of their profession. An operation was attended with almost the formality of an execution. The hardest of them are described as steeling themselves to the duty of operating. John Hunter spoke of operations as "humiliating examples of the imperfectness of the science," and pictures the operating surgeon "as an armed savage." He says: "No surgeon should approach the victim of his operation without a sacred dread and reluctance, and should be superior to that popular *éclat* generally attending painful operations, often only because they are so."

Abernethy and Cheselden regarded operations as the reproach of surgery. Abernethy felt the strain of operating keenly; it was an added hardship for him to work on a patient who bore pain with fortitude. It is reported that he felt such repulsion to operations that he regarded them as having no place in surgery as a science.

An anecdote illustrating his feeling is related by his biographer. He was performing a severe operation on a woman. He had, as was usual, given her some words of encouragement before he began, and the patient was bearing the pain with great bravery. After suffering some seconds she said earnestly, "I hope, sir, it will not be long."

"No, indeed," replied Abernethy, with great feeling; "that would be too horrible."

Cheselden is said to have seldom slept the night before an operation, so much did he dread it; yet he was always cool and firm and dextrous in its performance.

It is probable that the dread of patients was not confined to the operation, for in early days the after-treatment was of the most torturing description. Every flap of skin, instead of being reunited, was cut away; every open wound was dressed as a sore, and every deep one was plugged up with a tent lest it should heal. No attempt at first intention was made. Long tents were thrust into wounds of the neck and cheek until the neck and head swelled enormously. Even in compound frac-

tures dressings were thrust between the ends of broken bones, as if they had been afraid of the formation of callus.¹

At the opening of the century the improvement of the technique of the French school was very noticeable. This was due not only to the organizing powers of Napoleon, but to the development of military surgery. The influence of such work as was done by Larrey upon French surgery must have been enormous. It is said that Larrey performed alone in one day 200 amputations after the battle of Moskowa. His operations were not confined to amputations alone. His memoirs contain accounts of double amputations of the thigh, resection of the head of the humerus, pharyngotomy for the removal of a portion of a bayonet compressing the laryngeal nerve, and several cases of wounds of the abdomen complicated with injury of the intestines and bladder—all successful.

Larrey points out that Faure reported after the battle of Fontenoy that of 300 amputations only 30 recovered, but that in his cases three-fourths of the patients recovered. He attributed these results to primary operations and to a more simple, speedy, and less painful method of operation. The asepsis, which in a certain number of cases must have existed, is no doubt to be attributed to the rapidity, and therefore extreme simplicity, of the method employed. Warm camphorated or sweetened wine often formed an application on the dressing, and may have contributed to the favorable result.²

As severe a test as any upon his method was the successful excision of loose cartilages from the knee-joint. The operation consisted of a single cut while the skin was held tense, and was practically a subcutaneous operation, a plaster was quickly clapped on, and the wound healed by first intention. We may still be able to learn something from these old campaigners!

Ollier says rapidity was the quality demanded of all operators,

¹ Physic and Physicians.

² Larrey relates that after the battle of Moskowa he performed amputation at the shoulder-joint on a *Chef de Bataillon*, who immediately after the wound was dressed mounted his horse and departed for France. The horse died en route, but the officer arrived home safely.

with coolness and accurate anatomical knowledge. To operate well was a most difficult task. These operations were spectacular, but the dressers became afterward but too well aware of their imperfections. This was particularly true of operations for disease as contrasted with those for traumatism. From 1836 to 1841 major amputations for disease gave a mortality of 50 per cent., while those for traumatism were only 3 per cent. "The old operators endeavored to operate quickly; those of today endeavor to operate well."

The methods of civil practice were of the same rough-and-ready nature, and considerable skill was shown even by the country practitioner.

Blenkinsop¹ describes his first experience of this kind—his cross-country riding, with his principal, to an amputation :

"In this kind of practice," said my companion, "it is necessary to have our instruments well secured; you see I have mine strapped fast around my body; I lost them once when I was going to amputate an arm; but I sharpened a cheese knife and borrowed the carpenter's saw, and got through it pretty well."

Then follows the graphic description of their arrival at a small farm-house, of the doctor's interview with the man's wife, and of the nature of the injury, which involved an amputation high up in the thigh. The good wife having been disposed of by being sent on a fool's errand, the case was explained to the patient. "Meanwhile every preparation had been made, and the man's consent had scarcely passed his lips when the tourniquet was applied and the first cut made. 'Attend to me,' said the Doctor, 'watch everything I do, and I'll explain it afterward.' I felt a sad sickening and swimming of the head, but kept it down as well as I could, never for a moment taking my eyes off the quivering flesh; I nearly gave way when the bone was being sawed, but happily did not faint, and was as alert and attentive as possible. The operation, I think, scarcely exceeded ten minutes, and when the wife returned the patient expressed himself comfortable and nearly free from pain."

It is hardly necessary for me to enumerate before such a body as this the rapid improvements which took place in surgery

¹ Memoirs of Dr. Blenkinsop, written by himself. London, 1852.

under the lead of the masters of the French and English schools in the early part of this century. The scope of operative surgery was thereby greatly increased, but some improved and elaborate methods brought with them prolongation of the operation and great increase of pain. People were afraid to undergo them. It was only the few who were made of sterner metal that had the hardihood to subject themselves to the ordeal. Such were the veterans of the Napoleonic campaigns, and Ollier relates how in his early days he had occasion to operate upon some of these men who refused etherization, which they regarded as the refuge of cowards, and laid motionless under the bistoury.

Of such material also was Dr. Ebenezer Hunt, who in 1789 consulted the councillors of the Massachusetts Medical Society in regard to a cancer near the ear. They decided that it must be eradicated. It was agreed that on the next day the operation should be performed. Accordingly in a full meeting Dr. John Warren was selected as the operator. "We must bind his hands," said Dr. Warren. "No cable in Boston could hold them fast," rejoined Dr. Hunt, and with an effort that astonished the physicians themselves he quietly laid his head upon the pillow and bade them begin. The ear was nearly cut off, though afterward successfully replaced, then for thirteen minutes the operation continued and every stroke of the knife so near the auditory nerve was like the report of a pistol. Dr. Hunt did not flinch in the least, though the sweat poured down his cheeks profusely. At length all was done, and as he raised his stately form his first words were "Now give me a certificate." Dr. Warren did not understand him, and asked for what reason. "Why," continued Dr. Hunt, "that I was not cropped for making money."

Cases have been reported of death from fright before the operation. Dupuytren said "*La douleur tue comme l'hémorrhagie.*"

John C. Warren writing a year after the introduction of anæsthesia says: "In order to form a proper estimate of the value of the new practice, we should endeavor to realize the mental condition which precedes a surgical operation. As soon as a patient is condemned to the knife what terrors does his

imagination inflict? How many sleepless nights and horrible dreams and sinking of the heart does he experience? What apprehension of dangerous bleedings of wounds of vital parts and even sudden death does he paint to himself? And when to these is added the dread of insupportable pain, what a frightful picture presents itself to his mind? No wonder many persons are unable to bring themselves to submit. No wonder that some, worn out to desperation, are led to anticipate their sufferings by a voluntary death. Horror of the knife led a gentleman in this city afflicted with stone in the bladder to commit suicide." And well might he dread "the exquisite suffering, the spasmodic contraction of the wounded muscle, the irregular pouch-like contractions of the muscular coat of the bladder" which acted as obstacles to the operation of lithotomy before the days of ether. The same author stated in a paper in 1844 that in the course of forty years he had been called on to perform all the operations for stone which had been done in Boston. The whole number had not exceeded twenty-five cases.

It is not to be wondered that surgery languished, and that the old feeling against surgery which was so strong in the last century should leave traces of it among the representatives of surgery of the first half of the present century. Robert Liston, only two years before ether was first used, held practically the same opinion as to the operative part of surgery. In a lecture on operative surgery given in the University College Hospital in 1844, he says: "This is regarded as an inferior part of our professional duties, and truly it is so. The field of operative surgery, though happily narrowed, is still extensive."

What a contrast? A great surgeon two years before the dawn of anæsthesia rejoicing that the field of operative surgery was narrowed.

Students of surgery were taught how to give the least pain. Liston's directions were as follows:

"The divisions of the skin must inflict pain; but there is a way to render it less severe than it would otherwise be. The mode of cutting must be acquired to attain this desirable end. In the first place, you

must not divide the skin by scratches. You must carry the knife completely through the tissues at once, and doing it with rapidity you will save the patient a great deal of pain. Then, again, by cutting the skin from within outward, instead of from without inward, you diminish suffering. This mode may be adopted in many operations. In hernias, the removal of tumors, and in many amputations, the parts may be divided in this way with one-twentieth part of the suffering, often enough most unnecessarily inflicted."

Many surgeons abandoned the use of the knife and employed caustics in the eradication of tumors and other forms of chronic disease.

Amputation by transfixion was generally adopted as being not only more rapid but much less painful.

ANÆSTHESIA.

The records of ancient history show that physicians and surgeons had in mind the possibility of an agent being discovered, the use of which might prevent pain in surgical operations. The various potions that were from time to time recommended for this purpose have little more than an antiquarian interest.

Although it has been said that the discovery of surgical anæsthesia was a surprise, that its advent was marked by no tentative steps, that it appeared to have had no preliminary experimental stage, but burst like a revelation upon the medical profession as well as the community, virtually in the fulness of perfection;¹ yet a retrospective glance at the history of the previous half century will show that the idea was working in men's minds more powerfully than before, and that, as Paget says, a great truth lay unobserved, though it was covered by only so thin a veil that a careful physiological research must have discovered it. Dotted here and there over this stretch of time we find suggestions and hints full of significance today, but which at that period found no congenial soil in which to

¹ Hodges: The Introduction of Surgical Anæsthesia.

germinate into a substantial addition to the knowledge of the world. One of the earliest of these was that of Davy.

Sir Humphrey Davy, a pupil of Mr. Borlase, a surgeon at Bodwin, had acquitted himself so well in the study of chemistry that he was invited by Dr. Bedoes, of Bristol, to become the Superintendent of a Pneumatic Institution established at Clifton for the purpose of trying the medicinal effects of different gases. After two years' work he published, at the age of twenty-two, an essay on chemical and philosophical researches concerning nitrous oxide. He observed the peculiar phenomena which gave it the name of "laughing gas;" and he saw people made temporarily insensible by it. Among other suggestions, being of a surgical turn of mind, he wrote in his papers: "As nitrous oxide in its extensive operation appears capable of destroying physical pain, it may probably be used with advantage during surgical operations in which no great effusion of blood takes place."

The striking peculiarity of this gas gave teachers on chemistry an opportunity to popularize their lectures by closing them with an exhibition of the laughing qualities of the gas, and it continued to be administered to individuals in small doses with this sole object in view; and the important fact hinted at by Davy was overlooked, as it was only when administered in a much larger volume that insensibility took place.

It was during one of these popular exhibitions, given in Hartford, in December, 1844, by Colton, that an individual while under the influence of the gas sustained several bruises which did not appear to cause him pain. This led one of the audience, Horace Wells, to remark, "A person might have a tooth extracted while under the influence of this gas and not experience pain." At Wells's request Colton went to his office and administered the gas to Wells while Riggs extracted a diseased tooth. The operation was a success, and Wells exclaimed after the effects of the gas had subsided, "A new era in tooth-pulling."

The popularization of laughing gas suggested the employment of other agents which might produce similar results. Thus

it was that ether came to be used on similar occasions as well as for "ether frolics" by medical students and others.¹ An article written in 1818, probably by Faraday, states that, "When the vapor of ether mixed with common air is inhaled, it produces effects similar to those occasioned by nitrous oxide." It calls attention to the necessity of using caution in experiments of this kind, and cites the case of a gentleman who was thrown into a state of prolonged insensibility by its use in this way.

Ether had already been known at this time for nearly a century, the earliest period at which this fluid was distinctly mentioned by the name of ether being in the *Transactions of the Royal Society* for 1730, by Godfrey. From this time on the attention of chemists was much directed to ether. It was also often used in the last century for the relief of spasmodic asthma, phthisis, and some other diseases of the chest. John C. Warren used it in Boston in 1805 to relieve the distress attending the last stage of pulmonary consumption, and very frequently after that, and notably in the year 1812 in the case of a member of his own family. Dr. Warren states that the manner in which it was applied was by moistening a handkerchief and placing it near the face of the patient. The quotations by Pareira of the dangerous effects produced in the above-mentioned experiment, related by Faraday, served evidently to ward off suspicion of its more useful qualities, and it still continued to be occasionally used for its medicinal virtues and for similar purposes as that to which nitrous oxide was devoted.

1

CAMBRIDGE, February 15, 1877.

MY DEAR DR. WARREN: Your note with regard to experiments with ether at the Massachusetts General Hospital in 1836 has reached me.

I remember well our amusement with sulphuric ether; Dr. Samuel Parkman was the House-surgeon, I was House-physician, and Mr. C. K. Whipple House-apothecary.

We were especially jubilant when Mr. Whipple ordered a fresh quantity of ether, for it was apt to deteriorate by keeping. Each tested it by breathing it from the bottle till it produced unconsciousness, the others watching the different effects upon each.

We also experimented upon rats in a glass-globe until they were entirely motionless and often wondered that the treatment did them no harm. But with all our experiments we never thought of trying the sensibility under ether, even by pricking with a pin. It was a great oversight.

As ever, sincerely yours,

MORRILL WYMAN.

It was on one of these occasions that a young man by the name of Wilhite, who was attending an entertainment given in Athens, Georgia, in 1839, compelled a negro boy to take ether. The boy resisted, but the ether was forced more energetically upon him, and complete insensibility took place. In this same year Dr. Crawford W. Long graduated from the Medical Department of the University of Pennsylvania and began practice in Georgia; and, it being a common occurrence to use ether in this way at social gatherings, it occurred to him to try the same agent in surgical operations. In 1842 he accordingly removed a small encysted tumor about one-half inch in diameter, and subsequently performed one or two other minor operations. He was not, however, fully satisfied that the anæsthesia was produced by the ether and that it was not the effect of the imagination. His patients were not carried beyond the "state of exhilaration," and he admits that having found ether impracticable, owing to the short duration of the anæsthetic state, he therefore abandoned it. Long came very near achieving success, but the conditions surrounding him were unfavorable to such a result. He lived in a little Southern country town remote from the centres of civilization; the germ of inspiration received no encouragement, and the great opportunity was missed.

Meanwhile Wells followed up his first experience by extracting several teeth, four in all, from several individuals. Wells visited Boston in January, 1845, and applied to Dr. John C. Warren for permission to try the gas. The experiment was made before the class, but the patient screamed with pain, and the spectators laughed and hissed. Wells' failure was due to his neglect to depart from the ordinary plan of administering an exhilarating dose, only an amount of gas insufficient to insure anæsthesia. Again, it was a failure to recognize the necessity of an adequate dose which prevented the achievement of success. Wells soon abandoned dentistry on account of his health, and the following year departed for Europe as a business agent. He never perfected the method of administration of nitrous oxide gas.

Colton, who made annual lecture tours, continued to use the gas in his lectures in chemistry merely as an agent to amuse and interest his audience, and was in the habit of referring to the work Wells had done; but the public, remembering the fate of Wells, was not convinced, and no physician or dentist attempted to use it. It was not, therefore, until fifteen years after the death of Wells that Colton succeeded in bringing the gas into general use as an anæsthetic agent in dentistry.

Anæsthesia had been the dream of many surgeons and scientists, but it had been classed with aërial navigation and other improbable inventions.

Warren refers to the sinking of the heart he felt in the distress of very painful operations to which no habit could render him insensible. Such feelings led to various trials with many different agents—with opium in all its forms, and other narcotics, even in such quantities as really alarmed him, without any satisfactory results.¹

The first scientific account of the employment of hypnotic anæsthesia for surgical purposes was given by Recamier and Baron de Potel in about 1821. It was recommended by Cloquet in 1829, who removed a cancer of the breast by its use, without pain. Esdale began to employ it as an anæsthetic in surgery in 1846.² In Boston it was used successfully in the extraction of a tooth in 1836, the patient remaining under its influence about seventeen minutes;³ but Warren states that mesmerism had never succeeded in cases under his inspection.

In 1839 Velpeau wrote: "To escape pain in surgical operations is a chimera which we are not permitted to look for in our day. A cutting instrument and pain in operative medicine are two words which never present themselves, the one without the other, in the minds of the patients, and it is necessary for us surgeons to admit their association."

Scientific men were, however, now beginning to turn their

¹ Warren on Etherization, 1848.

² American Journal of Obstetrics, September, 1896.

³ Boston Medical and Surgical Journal, July 6, 1836.

attention to these anæsthetic agents. For instance, M. Ducros¹ presented a memoir to the Academy of Science in Paris, in which he showed that sulphuric ether applied to the buccal and pharyngeal membranes of certain animals produced an immediate sleep, and that it produced similar effects on man. He recommends its use in this way in hypochondriasis and insomnia. Rubbed upon the tongue, the soft palate, and the tonsils ether produces an agreeable sleep. He advises its use also in puerperal eclampsia, in hysterical and epileptiform attacks, and in trismus. Virchow also states that in Berlin, in 1846, he had made independent investigations on "æther narkose."²

Warren said of ether in 1848: "Its general properties have been known for more than a century, and the effect of its inhalation in producing exhilaration and insensibility has been understood for many years, not only by the scientific, but by young men in colleges and schools, and in the shop of the apothecary, who has frequently employed it for these purposes." Ether was even used in surgery, Thacher, of Plymouth, employing it as a refrigerator for the reduction of strangulated hernia.

Such was the situation when we first begin to hear of Morton. As a dentist he had introduced a new form of plate, which necessitated the removal of the old fangs. For this purpose he had on one occasion been obliged to use as much as 500 drops of laudanum in forty-five minutes. Finding that he was not successful in persuading patients to submit to his methods of treatment, and that they were leaving him for other dentists, he was led to seek for some method of painless extraction. In July, 1844, he used sulphuric ether, locally applied, to relieve the pain of a sensitive tooth. It is said that Jackson had recommended chloric ether to several dentists as effective "toothache drops" about this time. Morton had been at one time an inmate of Jackson's house, and doubtless had an opportunity to listen to the discussion of some of the more important chemical problems of that day, and heard of the

¹ Gazette Médicale de Paris, March 16, 1846.

² Boston Medical and Surgical Journal, October 15, 1896.

ether frolics and what Jackson thought of them. As a former partner of Wells, he was quite familiar with his work, and after Wells' Boston failure his experiments on the local use of ether came back to his mind, and the thought occurred to him to use ether as Wells had nitrous oxide. Doubtless, also, the well-known effect of ether as an exhilarant was as familiar to him as it was to other young students of that day. During the following spring and summer he experimented with ether upon several kinds of animals, and also upon students in his office. The result so far as the students were concerned were, however, not successful, as the article then supplied by druggists was not of good quality. Having acquainted himself by conversation with Mr. Metcalf and Mr. Burnett, both leading druggists, as to the purity and qualities of ether, and having also conversed with Mr. Wightman, a philosophical instrument-maker, and with Dr. Jackson as to an inhaling apparatus, Morton proceeded to experiment upon himself. After inhaling the purer quality of ether from a handkerchief he awoke to find that he had been insensible for seven or eight minutes.

The same day a stout, healthy man came to his office suffering from great pain and desiring to have a tooth extracted. Dreading the pain, he accepted willingly Morton's proposal to use ether, and the tooth was extracted without suffering. Morton reported his success the next day to Jackson, and conversed with him as to the best methods of bringing his discovery to the attention of the medical profession and the public. Jackson pointed out that tooth-pulling was not a sufficient test, as many people claimed to have teeth pulled without pain. It was finally decided that the crucial test lay in a public demonstration in the operating-theatre of a hospital in a surgical case.

Dr. J. Mason Warren, one of the actors in the scene, thus describes what next took place :

"In the autumn of 1846 Dr. W. T. G. Morton, a dentist in Boston, a person of great ingenuity, patience, and pertinacity of purpose, called on me several times to show some of his inventions. At that time I introduced him to Dr. John C. Warren. Shortly after, in October, I learned from Dr. Warren

that Dr. Morton had visited him and informed him that he was in possession of or had discovered a means of preventing pain, which he had proved in dental operations, and wished Dr. Warren to give him an opportunity in a surgical operation. After some questions on the subject in regard to its action and the safety of it, Dr. Warren promised that he would do so. . . . The operation was therefore deferred until Friday, October 16th, when the ether was administered by Dr. Morton and the operation performed by Dr. Warren."¹ The operation is thus described by Dr. John C. Warren :²

"The patient was a young man, about twenty years old, having a tumor on the left side of the neck, lying parallel to and just below the left portion of the lower jaw. This tumor, which had probably existed from his birth, seemed to be composed of tortuous, indurated veins extending from the surface quite deeply under the tongue. My plan was to expose these veins by dissection sufficiently to enable me to pass a ligature around them. The patient was arranged for the operation in a sitting posture, and everything made ready ; but Dr. Morton did not appear until the lapse of nearly half an hour. I was about to proceed, when he entered hastily, excused the delay, which had been occasioned by his modifying the apparatus for the administration. The patient was then made to inhale a fluid from a tube connected with a glass globe. After four or five minutes he appeared to be asleep, and was thought by Dr. Morton to be in a condition for the operation. I made an incision between two and three inches long in the direction of the tumor, and to my great surprise without any starting, crying, or other indication of pain. The fascia was then divided, the patient still appearing wholly insensible. Then followed the insulation of the veins, during which he began to move his limbs, cry out, and utter extraordinary expressions. These phenomena led to a doubt of the success of the application ; and in truth I was not satisfied myself, until I had, soon after the operation and on

¹ J. Mason Warren : *Surgical Observations, with Cases*, 1867.

² John C. Warren : *Etherization*, 1847.

various other occasions, asked the question whether he had suffered pain. To this he always replied in the negative, adding, however, that he knew of the operation, and comparing the stroke of the knife to that of a blunt instrument passed roughly across his neck." To resume Mason Warren's account: "On the following day a woman requiring the removal of an adipose tumor from the arm was rendered insensible by ether given by Dr. Morton; and Dr. Warren requested Dr. Hayward, one of the visiting surgeons who was present, to perform the operation. This was successful; the ether being continued through the whole operation, which was a short one, and the patient being entirely insensible."

Dr. John C. Warren writes: "Anxious to extend the benefits of the inhalation to as many patients as possible, believing a peculiar apparatus necessary, and having the use of none excepting that in the hands of Dr. Morton, I requested Dr. Charles Heywood, the house surgeon of the hospital (who took an early and active interest in this matter) to procure a glass globe and add to it the tube necessary for its application. At this period, however, I was checked by the information that an exclusive patent had been taken out, and that no application could be made without the permission of the proprietor. The knowledge of this patent decided me not to use nor encourage the use of the inhalation until a more liberal arrangement could be made. Dr. Hayward concurred with us, and having procured from Dr. Morton a letter of explanation to the surgeons of the hospital which was judged satisfactory, we felt ourselves justified in prosecuting the practice without restriction."

Resuming Mason Warren's account, we find that after the second operation:

"The success of this process in the prevention of pain was now quite established. Its use, however, was suspended for a time, for reasons which Dr. Warren has already given in his first paper on ether. And the experiments were not again resumed until November 7th, when Dr. Morton declared his willingness to state the nature of the agent employed. Two important operations were now done successfully at the Massa-

chusetts General Hospital under its agency: one, an amputation of the thigh by Dr. Hayward; the other a very difficult and bloody operation—removal of a portion of the upper jaw in a woman—by Dr. Warren.”¹

On December 21st Liston, in London, amputated a thigh and performed an evulsion of the toe-nail with perfectly satisfactory results. It is related that Liston’s surprise and delight at the success of his first use of ether were remembered for years after by his assistants and the spectators.

Dr. F. W. Fisher, of Boston, then a medical student in Paris, first gave ether for Jobert de Lambelle on December 15th, but with only partial success. On January 12th Malgaigne reported to the Academy of Medicine the results of four operations performed under ether at the St. Louis Hospital; and on January 23d Fisher administered ether with a “Boston Inhaler,” at the invitation of Roux, with perfect success.

As is frequently the case in this country, the new home product was not received with the enthusiasm it would have been had the same emanated from one of the great European clinics. In one great hospital it is recorded a year after this discovery that ether had not been used, “being considered by the judicious surgeons of that institution of doubtful safety, or, at least, as not sufficiently established as to warrant them in its employment.” Many major operations were performed in Philadelphia without anæsthesia as late as 1850 or even later.

¹ Dr. John C. Warren was the senior surgeon of the hospital at this period and the leading surgeon in New England, if not in the country. Holmes said of him: “He had reached the age when men have long ceased to be called for military duty; when those who have labored during their days of strength are expected to repose, and when the mind is thought to have lost its aptitude for innovating knowledge, and to live on its accumulated stores. Yet nothing could surpass the eagerness with which he watched and assisted in the development of the new discovered powers of etherization. It is much for any name to be associated with the triumphs of that beneficent discovery; but when we remember the reproach cast upon Harvey’s contemporaries, that none of them past middle age would accept his new doctrine of the circulation, we confess it to have been a noble sight when an old man was found among the foremost to proclaim the great fact . . . strangely unwelcome as well as improbable to some who should have been foremost to accept it—that pain was no longer the master but the servant of the body.”

It was not at first thought necessary to give more than a single dose of ether. Continuous etherization was only gradually reached. Many prolonged operations could not therefore at first be carried on by this method. In order to convince those who were still doubting, the members of the Massachusetts Medical Society at their annual meeting in May, 1847, were invited to visit the Massachusetts General Hospital and witness operations under ether.

"After two operations with etherization, which succeeded perfectly, a delicate female, laboring under a disease of the spinal marrow, with general neuralgia, was subjected to the actual cautery. A space on each side of the dorso-lumbar region of the spine was cauterized by red-hot irons, one of which was an inch square, passed up and down slowly three times on each side without the slightest suffering."

An eye-witness to this event informed the writer many years ago that when the assembled physicians saw and smelled the cloud of smoke ascending to the roof of the operating-theatre while the patient was slumbering peacefully, all doubts as to the efficacy of the new method vanished forever.

Thus the great step was taken, the "thin" veil was suddenly thrown aside, and what had been before a surmise of the scientist, a pastime of the idle student, and the dream of the surgeon, suddenly assumed practical form and shape, and became a living truth revealed in all the fulness of perfection.

In looking back over the period just outlined, a half century later, it seems as if the observer could see with a clearer vision and reason with calmer judgment. The minor controversies of those days have already faded into the past, while the salient truths stand out all the more clearly.

In due course of time science gave first one and then another anæsthetic to the world, but the world toyed with them for half a century, nearing and receding from the truth in a tantalizing way until a practical man came forward, pushed aside one or two apparently unimportant obstacles, and, guided by good advisers, was fortunate enough to put the new method to that crucial test for which it had so long waited. As Ashhurst has

well said: "Surgeons went on in every country cutting and burning, and patients went on writhing and screaming until, on October 16, 1846, when surgical anæsthesia became the priceless heritage of the civilized world."

SURGERY AFTER ANÆSTHESIA.

Warren, writing in 1848, says: "A new era has opened to the operating surgeon. With what fresh vigor does the living surgeon, who is ready to resign the scalpel, grasp it and wish again to go through his career under the new auspices? Since the fear of pain has diminished, the number of surgical operations has remarkably increased, at least in our vicinity."

An editorial article in the *Lancet*, written about six months after ether was first used in Boston, states that the number of operations in the London hospitals had more than doubled.

Mason Warren writes: "The domain of surgery has been enlarged by admitting into the list of justifiable operations some whose severity would otherwise in most cases have prevented even the thought of attempting them."

Erichsen writes in 1878: "During the last thirty years the actual number of operations performed in hospitals has enormously increased, and probably in a great measure owing to the employment of anæsthetics."

Marshall, the Emeritus Professor of Surgery at the University College Hospital, in 1885 compared the surgical work of the hospital in Liston's time, in 1844, and his own.¹

Although the proportion of fractures and wounds was about the same in the two periods under comparison, the number of surgical cases admitted to the hospital in 1885 was more than double the number admitted in 1844. A numerical comparison, however, gives an inadequate idea of the increased amount of surgical cases, for in 1844 simple cases were treated as out-patients, and venereal cases in large numbers were admitted to the wards. In 1883 more patients with malignant growths came

¹ British Medical Journal, August 8, 1885.

for operation. This was attributed not to the increase of malignant diseases, but to the willingness of persons to be operated upon under anæsthesia.

Diseases of the bones and joints did not differ much comparatively. Stricture of the urethra was operated upon very much more often in 1883.

In the whole year of 1844 there came into the surgical ward of the University College Hospital only one case each of ovarian tumor, of aneurism, and of vesico-vaginal fistula. Jones records¹ that from 1830 to 1850 he found no recorded case of excision of the knee, but in 1850 to 1854 there were twenty-one cases. With the increase in surgical work came a great increase in the relative cost of hospital maintenance. In the University College Hospital the expenses for surgical supplies in 1844 were £206, and in 1883 £1765, of which £1273 went for modern surgical dressings. The cost of instruments in 1883 was more than doubled.

The following table, taken from the record books of the Massachusetts General Hospital, enables one to compare the work done after the advent of anæsthesia with the period immediately preceding it:

	For five years before anæsthesia.		For five years after anæsthesia.	
	Number.	Mortality.	Number.	Mortality.
Total operations	184	6½ p.c.	487	9 p.c.
Tumors (excluding breasts)	39	5 "	122	3 "
Amputation of breast	13	8 "	30	10 "
Plastic operations	6	0 "	33	3 "
Amputations { Hand	13	15 "	65	23 "
{ Foot				
{ Arm				
{ Leg				
Hernia: Strangulated gut freed by incision	5	60 "	1	0 "
Reduced by taxis under ether	0	.....	2	0 "
Radical cure, plastic	0	.....	0	0 "
injection iodine	0	.....	11	0 "
Laparotomy	0	.....	4	75 "

¹ Medico-Chirurgical Transactions, 1854.

It will be noticed that there was a marked increase in the number of "voluntary" operations—*i. e.*, operations which were not matters of absolute necessity to preserve life—such as tumors or *operations de lux*, such as plastic surgery. The total number of operations during the five years following the introduction of ether was over two and one-half times as great as that in the five preceding years.

The question whether anæsthetics increased mortality or not was one which was much discussed formerly. Simpson believes that they did not. Arnott brought forward figures to show that the mortality had been increased 12 per cent. in amputations, and 28 per cent. in lithotomy. Erichsen also believed the mortality rate had increased since the use of anæsthetics in operative surgery. Curling gives the mortality of amputations of thigh and leg in the London hospitals for 1837–1843 at 41 per cent. During 1847 in 73 cases in which an anæsthetic was given the mortality was 19 per cent. At the Pennsylvania Hospital the mortality of amputation from 1835 to 1840 was 36 per cent.; from 1840 to 1845 it was 20 per cent. From 1850 to 1855 it was 23 per cent., and from 1855 to 1860 it was 31 per cent. At the Massachusetts General Hospital the death-rate was, as a rule, increased in the different classes of operations. The rapidity with which certain operations were performed undoubtedly favored asepsis, particularly in all aseptic cases, and probably in any operation which could be done quickly and thoroughly.

In many cases of spreading sepsis rapidity was a bar to thoroughness, and results were corresponding unsatisfactory.

A young man presented himself at the Hôtel Dieu in 1845, with palmar abscess, but as no opening was made, the arm became involved the following day, pus having found its way under the annular ligament. The bistoury was produced, plunged deeply between the pronators and supinators of the forearm, and carried up rapidly from the wrist to the bend of the elbow; the arm fell open and a pint of matter instantly escaped, but with it jets of florid blood from the brachial end of the wound. The brachial artery had to be tied, and when the reporter left Paris the surgeons were contemplating amputation at the shoulder-joint.—*Lancet*, January 11, 1845.

The contrast of anæsthesia in such cases is a strong one. The days of anxiety which visited patients and their medical advisers previous to an operation were, with the discovery of anæsthesia, immediately swept away, and the problem of the relief of disease by surgery became vastly simplified. Surgeons could now operate promptly but with deliberation and thoroughness.

The enormous increase in the number of surgical cases brought about conditions for which hospitals and surgeons were alike unprepared.

When we reflect how few of the aids to surgical diagnosis were possessed by surgeons in 1846, the amount of work which they accomplished presents all the stronger contrast. They had no endoscope, no ophthalmoscope, no modern aspirating-needle, no clinical thermometer, and no laryngoscope. The stethoscopes were far from perfect. Examination of the blood and the quantitative analysis of the excretions were unknown. The microscope was just coming into use for pathological purposes. They possessed, however, an excellent technique so far as operative surgery was concerned. Their capacity for operating was unlimited, but their judgment was not guided by the many aids which serve us today.

There was an activity in the operating-theatre in times of peace that had never before been known. But with this great increase in hospital activity came a corresponding increase in hospital pests, and it seems highly probable that during the twenty years following the introduction of anæsthesia the opportunity to study septic diseases was greater than it ever had been. Mason Warren, writing in 1864, says: "I remember the time when, after an amputation or the excision of a breast or a large tumor, it was the universal rule to bring the edges of the cut integuments together nicely with straps, compress, and a bandage, with the full assurance of finding the wound nearly healed at the removal of the dressing. At the present day, however, such a result is seldom attained in city practice; union by first intention being for the past twenty years the rare exception, suppuration almost always ensuing in the deeper parts."

In about 1860 septic processes ran rife at the Massachusetts

General Hospital, and the writer well remembers a virulent epidemic of hospital gangrene which got quite beyond the control of the surgeons. In the winter of 1867 and 1868, in Vienna, Billroth's wounds were full of pyæmia, erysipelas, and hospital gangrene, as the autopsy table but too frequently showed. Students and many practitioners of today have but a faint conception of the appearances of wounds and ravages of sepsis with which the surgeon of that time had to contend. As a house officer at the Massachusetts General Hospital, I can well remember the tone of despair with which my father remarked, on learning from me of a fatal result following one of his operations: "I am often nearly disgusted with surgery."

It would be beyond the scope of this article to undertake to show how the speculation of Liebig¹ and others became tremendous truths in the hands of Pasteur and Lister, and the beneficent influence which the next great discovery of the century exerted upon human suffering.

It is interesting to note, however, the strangely appropriate order in which the great facts of medicine and surgery were given to the world in this progressive century. Hunter had already roused the thirst for knowledge which led others to rush forward and immortalize themselves as pioneers in anatomy, like Bichat, or modern surgery, like Cooper. Then came the work of the pathologists, such as Cruveilhier and the host of German pioneers. Just as the surgeon had brought his operative technique to a high degree of perfection, and science had made a practical instrument of the microscope, and preparation had been made for another advance all along the line, then came anæsthesia, which widened the field of research sufficiently to occupy the world busily for another quarter of a century. It gave to surgery a more powerful impetus than it did to experimental medicine. At a moment when surgery seemed rushing

¹ Liebig in a lecture delivered in the spring of 1844 said, in speaking of fermentation and putrefaction, "I cannot conclude without mentioning a notion which some persons, and especially physicians, have formed respecting causes. The putrefaction of animal substances they ascribe to the development of microscopic animalculæ—vegetable beings—fungi. The correctness of the theory was denied by Liebig at this time.

wildly onward to its own destruction, with science lagging far behind, Lister came to the rescue, and scientific equilibrium was again restored.

Gentlemen : The old Massachusetts General Hospital stands as it did in 1846, with its sightly Bulfinch dome and granite columns. From a scientific standpoint it seems an antiquated structure in comparison with the modern pavilion wards, laboratories, and operating-theatres which surround it, but it will never be torn down. It will always remain one of the conspicuous landmarks of this wonderful century—as a shrine of surgery sacred to that moment “when the fiercest extremity of suffering was steeped in the waters of forgetfulness, and the deepest furrow in the knotted brow of agony was smoothed away forever.”

[NOTE.—The illustration represents the operating-theatre of the Massachusetts General Hospital in the winter of 1847. The sponge used here is known as the first sponge with which ether was given. This method was adopted in February, 1847, by Dr. J. Mason Warren. The surgeons whose portraits appear in this picture are, on the patient's left, Dr. John C. Warren, Dr. Samuel Parkman; on the patient's right, Dr. J. Mason Warren and Dr. Townsend. The etherizer is probably Dr. Heywood. The daguerrotype from which the photogravure is taken has been in the possession of the writer's family since that time.]

